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A Comprehensive Approach in Calculating the Impact of the Ground on Radiated Electromagnetic Fields Due to Lightning

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Abstract : The influence of finite ground conductivity is of great importance in calculating the induced voltages from the radiated electromagnetic fields due to lightning. In this paper, we try to give a comprehensive approach to calculate the impact of the ground on the radiated electromagnetic fields to lightning. The vertical component of lightning electric field is calculated with a reasonable approximation assuming a perfectly conducting ground in case the observation point does not exceed a few kilometres from the lightning channel. However, for distant observation points the radiated vertical component of lightning electric field is attenuated due finitely conducting ground. The attenuation is calculated using the expression elaborated for both low and high frequencies. The horizontal component of the electric field, however, is more affected by a finite conductivity of a ground. Besides, the contribution of the horizontal component of the electric field, to induced voltages on an overhead transmission line, is greater than that of the vertical component. Therefore, the calculation of the horizontal electric field is great concern for the simulation of lightning-induced voltages. For field to transmission lines coupling the ground impedance is calculated for early time behaviour and for low frequency range.

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